Rurality and Nursing Home Quality: Results from a National Sample of Nursing Home Admissions

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Objectives. We examined differences in quality of care among nursing homes in locales of varying degrees of rurality.

Methods. We classified locales into 4 classes according to rurality. We analyzed a 10% sample of nursing home admissions in the United States in 2000 (n = 198 613) to estimate survival models for 9 quality indicators.

Results. For postacute admissions, we observed significant differences in rates of decline for residents in facilities in large towns compared with urban areas, but differences in quality were both negative and positive. Among admissions for long-term or chronic care, rates of decline in 2 of 9 quality areas were lower for residents in isolated areas.

Conclusions. We observed significant differences in a number of quality indicators among different classes of nursing home locations, but differences varied dramatically according to type of admission. These differences did not exhibit the monotonicity that we would have expected had they derived solely from rurality. Also, quality indicators exhibited more similarities than differences across the 4 classes of locales. The results underscore the importance, in some instances, of emphasizing the effects of specific settings rather than some continuum of rurality and of moving beyond the assumption that nursing home residents constitute a homogeneous population. (*Am J Public Health.* 2004;94:1717–1722)

The demographic shift in the United States to a significantly older population has been well-documented. Estimates are that 1 in 5 persons in the country will be aged 65 years or older by 2030.[1] However, for the planning of service delivery systems and planning for change in these delivery systems, it is also critical to understand the geographic distribution of the elderly. Rurality is a significant factor in gauging the proportion of a locale's population that is elderly and likely to need long-term care services. In urban areas in 2000, only 5.6% of the population were aged 75 years or older, whereas in isolated rural areas the percentage was roughly one third higher (7.4%). In nonurban areas, this aging population has resulted in relatively higher rates of nursing home use, with over 560 000 nursing home residents receiving care in nursing homes operating outside metropolitan areas.[2]

Researchers interested in nursing homes in rural areas have focused largely on an array of topics emphasizing access and utilization rather than quality of care. They have shown interest in the "premature" use of nursing homes in rural areas,[3] the characteristics of admissions to urban and rural nursing homes,[4,5] and differences in other aspects of nursing home and long-term care use.[6–10] Much less attention has been given to questions of quality differences in homes in locales differing in rurality.[11] Only recently has research on quality of care in rural nursing homes begun to appear. Recent literature now contains comparisons of feeding tube use in urban and rural homes in 1 state,[12] data on multiple hospitalizations from 6 states,[13] and a more general analysis of quality indicators in a single state.[14]

The research presented in this article attempts to move beyond previous research on quality of care in rural nursing homes through (1) use of an admission cohort to alleviate problems in risk-adjustment; (2) use of a measure of rurality that includes commuting patterns as well as population; (3) the merging of individual and home characteristics; and (4) use of a nationally representative sample of individuals admitted to certified nursing homes. These differences allow the research team to make, for the first time, statements about quality differences in urban and rural nursing homes that are generalizable to the nation as a whole.

METHODS

Database

The data used in this research came from the national archive of Minimum Data Set (MDS) assessments maintained by the Centers for Medicare and Medicaid Services (CMS). The MDS is a multidimensional assessment instrument used to assess all residents in Medicare- or Medicaid-certified nursing homes. Residents are assessed fully at admission and then annually. Quarterly assessments are performed with a subset of MDS items. The MDS has demonstrated reliability and validity when used in studies based on data collected in research studies and in studies based on archival data.[15–18]

We analyzed a 10% sample of all nursing home admissions during calendar year 2000. Ten percent of the records from each home in the database were randomly selected, and assessments for each resident were identified for the 12 months following admission. All assessments for each individual were merged to create a longitudinal, resident-level file. Information on the nursing homes themselves was obtained from CMS's Online Survey and Certification Automated Reporting System for calendar year 2000 and merged with resident records.

This process resulted in a sample of 198 613 nonduplicated nursing home residents admitted to 1 of 17 107 nursing homes during calendar year 2000. An admission cohort was used because it does not present the same problems with risk adjustment that arise when using data from a sample of current nursing home residents. In analyses of outcomes in acute care settings, the risk-adjustment process focuses on patient status at admission.[19] In analyses of nursing home quality of care, admission data are often ignored, and data on current resi-

dents are the basis for quality indicators and risk-adjustment models.[20]

Unfortunately, appropriate risk adjustment in long-term care is difficult when using data on current residents. For example, when looking at the development of pressure ulcers, researchers often adjust for the fact that a resident is confined to a bed. Those residents who are confined to bed are at greater risk of developing a pressure ulcer. However, the resident may be confined because of a home's earlier failure to provide care necessary for the resident to maintain mobility. As this example illustrates, differentiating between those factors on which a home can have an effect and those on which it can have no effect is difficult when data from current residents are used.

These problems are largely alleviated when data from an admission cohort are used. A resident's health and financial status at admission are not the responsibility of the home to which the resident is admitted. However, changes in health status that occur in the nursing home after admission can be considered the results of 3 factors: resident's status at admission, provider behavior, and random factors. Controlling for resident status at admission in a multivariate model then leaves changes in status as the result of provider behavior (quality of care) and status changes attributable to random factors that should be evenly distributed across the population.

Defining the Time to Decline

The 9 dependent variables in this research reflect the time from admission to decline in resident status. For dichotomous variables, a negative outcome was the appearance of some condition not present at admission or the occurrence of some negative event. For ordinal indicators, a poor outcome was indicated by movement on a measurement scale from less to greater impairment. The outcome measures included pressure ulcer incidence, incidence of falls, decline in urinary continence, decline in activities of daily living (ADLs), decline in cognitive function, and incidence of a probable mood problem. The time from admission to the initiation of psychoactive medications was also used as a quality indicator. The date of problem incidence or decline was identified as the time from admission to the date midpoint between the assessment indicating a decline and the preceding assessment. Discharge from the nursing home to hospital and death were both treated as continuous dependent variables. Time to death was defined as the number of days from admission to death. Discharge to hospital measured the number of days from admission to the first discharge to an acute care hospital, psychiatric hospital, or mental retardation or developmental disabilities facility. In sum, these indicators represent the gamut of nursing home quality-of-care measures, covering 5 fundamental dimensions of resident status and quality of care: physical function, psychosocial well-being, cognition, specific health problems, and departure from the facility.

Defining the Variables

The dependent variables reflect time to decline in status or the incidence of some problem. The variables that served as the basis for the dependent variables also served as baseline covariates. Functional status was measured as a resident's dependency regarding personal hygiene, using the toilet, locomotion, and eating.[21] The 6-level ADL scale is hierarchical, with categories representing independence, different levels of assistance in early- and mid-loss ADLs, and total dependence in late-loss ADLs. Cognitive function was measured using the 7-level Cognitive Performance Scale (CPS), which includes variables reflecting impairment in short-term memory, making oneself understood, decisionmaking, consciousness, and eating.[22,23] Mood was measured using a dichotomous version of the MDS Depression Rating Scale.[24] The pressure ulcer indicator reflected the presence of a stage 2, 3, or 4 pressure ulcer in the 7 days before an assessment. The falls indicator measured whether the resident fell within the 180 days before an assessment. Urinary incontinence was measured by means of the 5-level MDS indicator for bladder control. The introduction of psychoactive medications included antipsychotics, anxiolytics, and hypnotics. The variable was dichotomous, indicating that no psychoactive medications were prescribed or that a resident received a new prescription for a psychoactive medication.

The independent variable of primary interest was the home's location class. Locations were classified using the rural–urban commuting area codes.[25] These codes combine the population of a zip code with the commuting patterns for the population in that zip code. Locations were classified into 4 categories, each representing (respectively) greater levels of rurality: urban (i.e., a city with a population >50 000 and its commuting area), large town (i.e., a city with a population of 10 000–49 999 and its commuting area), small town (i.e., a city with a population of 2500–9999 and its commuting area), and isolated areas (i.e., remaining areas).

Although most of the independent variables were baseline measures of the dependent variables, other variables were used only as covariates. These variables included the following: the major payer for a resident's admission, the occupancy rate for the home, the home's ownership arrangement (i.e., for-profit, not-for-profit, government), the percentage of a home's residents whose stay was paid for by Medicare, nurse staffing per resident per day, and resident acuity (i.e., case mix) in the home. Home case mix was measured using the average Resource Utilization Groups III nursing case-mix index for all nursing home residents.[26] The staffing variable was the sum of registered nurse, vocational nurse, and nurse aide hours per resident per day in each home at the time of its certification and licensure survey. This variable was classified into 7 categories. Age and gender were included in the models as ordinal and dichotomous indicators, respectively. The final covariate was the 6-level Minimum Data Set–Changes in Health, End-Stage Disease and Symptoms and Signs (MDS–CHESS) scale, which measures clinical instability and is used to predict mortality and other adverse outcomes.[27] Each increasing increment represented greater frailty and likelihood of death.

Analysis Strategy

The first stage in the analysis was the development of descriptive statistics. Table 1 presents traditional quality measures for homes in each of the 4 locales. Table 2 presents descriptive statistics for the sample of nursing home admissions by location class. Table 3 examines the proportion of the sam-

TABLE 1—Traditional Quality Indicators (Staffing and Survey Deficiencies), by Nursing Home Location Class

	Nursing Home Location Class			
	Urban	Large Town	Small Town	Isolated
Average no. of deficiencies	7.0	6.4	5.9	5.0
Facilities at or above licensed nurse staffing threshold,[a] %	28.7	25.5	20.0	15.1
Facilities at or above CNA staffing threshold,[b] %	11.9	10.6	8.5	7.5
Median total nursing hours per resident per day	3.1	3.0	2.8	2.8

Source. Adapted from Phillips et al.[2]
Note. CNA = certified nursing assistant.
[a] The threshold level used here, 1.2 hours of licensed nursing time per resident per day, was established in a Centers for Medicare and Medicaid Services study.[28]
[b] The threshold level used here, 2.8 hours of certified nursing assistant time per resident per day, was established in a Centers for Medicare and Medicaid Services study.[28]

TABLE 2—Descriptive Statistics for Nursing Home Admissions, by Location Class

	Nursing Home Location Class			
Resident Characteristic	Urban	Large Town	Small Town	Isolated
Female, %	64.63	65.75	64.92	63.96
Aged older than 75 y, %	68.73	70.89	73.09	76.49
Postacute, %	70.49	76.67	68.06	59.23
Average nursing CMI (range: 0.46–1.7)	1.04	1.05	1.02	0.98
Average CPS score (range: 0–6)	1.77	1.76	1.93	2.08
Average ADLs score (range: 0–6)	3.49	3.40	3.39	3.26
Average MDS-CHESS score (range: 0–5)	1.79	1.88	1.83	1.74
Sample size, n	148 659	23 009	17 111	7908

Note. CMI = case-mix index; CPS = Cognitive Performance Scale; ADL = activity of daily living; MDS = Minimum Data Set; CHESS = Changes in Health, End-Stage Disease and Symptoms and Signs.

TABLE 3—Quality Indicators, % (SE), at 1 Year after Admission, by Location Class

	Location Class			
Quality Indicator	Urban	Large Town	Small Town	Isolated
Discharge to hospital (n = 84 143)	57.48 (0.32)	55.58 (0.73)	57.05 (0.66)	53.08** (0.87)
Death (n = 54 841)	33.75 (0.34)	36.45* (0.78)	34.43 (0.74)	31.42** (0.93)
Decline in ADLs (n = 24 941)	42.59 (0.40)	42.87 (0.91)	42.15 (0.95)	43.50 (1.19)
Decline in CPS (n = 26 034)	44.81 (0.40)	42.81 (0.93)	42.77 (0.92)	41.97 (1.17)
Incidence of mood problem (n = 28 663)	47.24 (0.41)	50.41 (0.97)	49.12 (1.00)	49.16 (1.23)
Pressure ulcer incidence (n = 20 771)	14.24 (0.31)	13.07 (0.65)	12.57 (0.66)	9.72** (0.77)
Falls (n = 18 502)	59.25 (0.46)	61.76 (1.06)	59.00 (1.10)	62.88* (1.29)
Psychoactive medications (n = 17 297)	35.03 (0.45)	35.07 (1.07)	33.32 (1.09)	28.77** (1.32)
Urinary incontinence (n = 22 980)	59.59 (0.42)	55.49** (0.96)	55.28** (0.98)	52.43** (1.21)

Note. ADL = activity of daily living; CPS = Cognitive Performance Scale. n's reflect the number of individuals capable of decline who were not censored during the year after baseline. All statistical tests are comparisons between residents in urban nursing homes and residents receiving care in a locale of another class.
*P < .01; **P < .001.

ple that declined for a specific quality indicator by home location class. The sample is restricted to include only residents that had the possibility of declining for a given quality indicator. For example, if a resident had the highest (worst) possible score on the CPS at admission, they could not decline over the next year. Such residents were excluded from the analysis of CPS decline. Similarly, if a resident entered the facility with a pressure ulcer, that resident could not decline on the pressure ulcer indicator.

Specifically, Table 3 presents the reduced sample estimator for each quality indicator by location class. The reduced sample estimator uses the fully observed (uncensored over the course of the year) data.[29] It is generally less efficient than the Kaplan–Meier (product limit) estimator when observed survival times (time to decline) and censoring times are independent. However, in our setting, censoring is often caused by discharge or death; thus, the censoring time is informative and is likely to be correlated with the time of decline. For this reason, we used the reduced sample estimator. Only differences statistically significant at $P<.01$ (for individual comparisons) are discussed because of the number of comparisons presented.

The results of survival analyses for the quality indicators appear in Table 4. All of the estimated models included the baseline values for the ADL scale, CPS, mood, and MDS–CHESS, percentage of residents supported by Medicare in the home, nursing home ownership and location class, resident's gender and age, payer, nursing case-mix index, and nurse staffing levels. To provide estimates based on more homogeneous populations, the sample was divided into 2 subgroups for these analyses: residents admitted for postacute care and residents admitted for chronic or long-term care.

To focus on the dependent variable of primary interest and to reduce the volume of information presented, Table 4 presents only statistically significant ($P<.05$) hazard ratios for home location class. Individual parameters for location class are presented only if the main effect for the entire variable was significant at $P<.05$. Cox proportional hazards models were estimated for continuous time variables, and proportional hazards models were estimated for discrete time variables. All

TABLE 4—Significant Hazard Ratios (95% CI), With *P* Values, for Nursing Home Location Classes and Quality Indicators at 1 Year after Admission: Postacute and Long-Term Care Admissions

	Nursing Home Location Class			
Quality Indicator	Urban	Large Town	Small Town	Isolated
Postacute admissions				
Discharge to hospital (n = 115 951)	1.00	0.89 (0.85, 0.94) *P* = .0000	NS	NS
Death (n = 115 951)	1.00	1.11 (1.04, 1.19) *P* = .0027	NS	NS
Decline in ADLs (n = 105 025)	1.00	NS	NS	NS
Decline in CPS (n = 109 026)	1.00	NS	NS	NS
Incidence of mood problem (n = 115 939)	1.00	1.12 (1.03, 1.22) *P* = .0106	1.12 (1.03, 1.22) *P* = .0116	NS
Pressure ulcer incidence (n = 90 049)	1.00	0.78 (0.66, 0.93) *P* = .0048	NS	NS
Falls (n = 71 551)	1.00	NS	NS	NS
Use of psychoactive medications (n = 80 197)	1.00	NS	NS	NS
Urinary incontinence (n=98,916)	1.00	0.90 (0.83, 0.98) *P* = .0172	NS	0.85 (0.76, 0.95) *P* = .0045
Chronic care admissions				
Discharge to hospital (n = 46 514)	1.00	NS	1.09 (1.02, 1.16) *P* = .0103	NS
Death (n = 46 514)	1.00	NS	NS	NS
Decline in ADLs (n = 45 525)	1.00	NS	NS	NS
Decline in CPS (n = 43 859)	1.00	NS	0.90 (0.82, 0.99) *P* = .0359	NS
Incidence of mood problem (n = 46 506)	1.00	NS	NS	1.14 (1.02,1.27) *P* = .0218
Pressure ulcer incidence (n = 38 484)	1.00	NS	NS	0.74 (0.56, 0.98) *P* = .0370
Falls (n = 30 616)	1.00	NS	NS	NS
Use of psychoactive medications (n = 29 983)	1.00	NS	NS	NS
Urinary incontinence (n = 37 928)	1.00	0.91 (0.83,1.00) *P* = .0486	NS	0.88 (0.78, 0.98) *P* = .0218

Note. CI = confidence interval; NS = not statistically significant at $P < .05$; ADL = activity of daily living; CPS = Cognitive Performance Scale; MDS = Minimum Data Set; CHESS = Changes in Health, End-Stage Disease and Symptoms and Signs.
[a] All the estimated models (except those for death and discharge) included the baseline value for the dependent variable. All models included baseline values for the ADL scale, the CPS, mood, the MDS–CHESS, percentage of residents whose stay was paid for by Medicare in the home, ownership, gender, payer, age, nursing case-mix index, and nurse staffing levels.
[b] n's for each dependent variable include all those capable of declining on that indicator, given their baseline status.

analyses were performed using SUDAAN to provide appropriate variance estimates for clustered data.[30]

RESULTS

Table 1 presents conflicting data on quality differences among facilities operating in different locales. Implying that quality of care in rural areas may be better, one sees monotonic decreases as one moves from urban to isolated facilities in the average number of quality-of-care deficiencies cited during annual certification and licensure surveys. At the same time, facilities' nurse staffing levels are often considered a good marker of quality,[28,31–35] and one sees a monotonic relationship between staffing levels and rurality. The percentage of facilities with staffing over the threshold levels (derived from a CMS study[28]) necessary to avoid poor outcomes grows smaller as locales become more rural. Although conflicting in their implications, the monotonicity displayed by both staffing and deficiencies implies analyses treating rurality as a continuum may be justified.

Table 2 presents descriptive statistics for the entire sample of nursing home admissions. As Table 2 indicates, the average age of residents and level of cognitive impairment increased with rurality. The level of ADL dependency, the percentage of short-stay residents, and nursing case-mix index decreased with rurality. Again, the data have somewhat conflicting implications for resident outcomes. Older age and higher cognitive impairment in more rural facilities imply a higher likelihood of poorer outcomes. However, higher levels of acuity and dependency in more urban facilities also imply a higher likelihood of poorer outcomes.

Table 3 presents the decline rates over the study year for each dependent variable across the 4 levels of rurality. Throughout this table, the differences fail to reflect the monotonicity suggested by a rural-urban quality differential that reflects some continuum. Only in urinary continence and pressure ulcer incidence did one see such a pattern in conjunction with at least 1 statistically significant difference. A total of 8 differences were significant at $P < .01$. Six of these indicated potentially better care in nonurban nursing homes, whereas the remaining 2 implied potentially poorer quality of care in nonurban facilities. Most of these differences were between urban homes and those homes operating in isolated areas.

As interesting as the bivariate results may be, the results of the multivariate models in Table 4 offer the best information concerning differences in quality among urban and rural homes. The first portion of Table 4 presents the results for those individuals admitted for postacute care. Five of the 7 significant parameters reflect differences for residents served in or near large towns. These results, though, provide a mixed picture of quality in those homes. In 3 of the 5 instances (i.e., discharge to hospital, pressure ulcer incidence,

and decline in urinary continence), residents in homes in large towns declined at slower rates. However, for mood status and death residents in such homes had significantly poorer outcomes relative to residents in urban homes.

The pattern of results for the chronic or long-term care admissions is at odds with that observed in the postacute population. The greatest differences in the rates of decline appeared between residents in urban homes and residents in homes operating in isolated locales. In 2 of the 3 significant differences for this group, one sees results implying that residents in isolated areas received better quality of care. The only result implying poorer quality of care in isolated areas was mood. For those in homes in or near small towns, differences indicate this population had higher rates of discharge to the hospital and lower rates of decline in cognition relative to residents in urban homes.

CONCLUSIONS

The results shown in Table 4 are mixed but do lead to some general conclusions. Differences in care for residents entering a home for postacute care were the most significant when care in urban homes was compared with care in homes serving towns ranging in population from 10 000 to 49 999. However, these results implied better care in some instances and poorer care in others. For residents entering homes for long-term care, results varied dramatically. Care provided by homes in isolated areas differed most from care provided in urban areas, and, in this instance, the majority of the differences implied better care for residents in homes in isolated areas.

Unfortunately, what remains puzzling is the cause of these differences. No coherent, falsifiable theory provides insight into these differences. However, reasonable conjectures are possible. In terms of postacute care, urban homes have almost always maintained a steady stream of long-term care admissions and a relatively high proportion of postacute admissions. However, in recent years, many nursing homes have moved more heavily into postacute care for the purposes of increased reimbursement, whereas homes located in isolated areas or small towns, understanding clearly the limitations of their location classes, may have made no such moves and maintained their earlier admission strategies. The same may not be true of homes in larger towns. If so, these homes may have moved into the world of postacute care but only partially mastered that care. Thus, one sees variations in care outcomes for postacute admissions in those homes.

The results for residents admitted for chronic or long-term care are comprehensible from a different perspective. Chronic care has always been the mainstay of nursing homes operating in isolated areas, and it may be that nursing home care in isolated areas is nested within a wealth of other social networks in ways not seen, or even possible, in other locales. Such networks should, even in the face of lower staffing levels, generate more care that is resident-centered than one finds in the more anomic world of nursing home care outside these areas. Thus, one sees arguably better outcomes of care for residents in homes located in isolated areas.

Although our article has emphasized observed differences, it is also appropriate to note that, in the most general sense, these results indicate that care differed across locales only on selected measures. For acute care, there were 7 statistically significant differences and 20 other comparisons that showed no significant difference. In chronic care, 6 significant differences were observed, whereas 21 comparisons indicated no significant differences. Although the observed differences are obviously important, it is also important to remember that nursing home care across these settings displayed more similarities than differences.

Whatever the final determination of our conjectures and conclusions may be in the face of further investigation, these results do clearly emphasize 2 important, general points that can provide guidance for future research on long-term care quality in different locales. First, at least in long-term care, it no longer seems appropriate to look at rurality as a continuum. Nursing homes outside a metropolitan area did not perform in the ways one would predict if rurality had a monotonic effect on quality of care. These results imply that it may be better to speak of differences based on the specifics of locale or setting rather than some more general concept of a continuum of rurality. Second, future researchers can benefit from differentiating among different types of nursing home residents when evaluating quality of care. The differences observed in rates of decline for postacute admissions differed substantially from those for long-term care admissions. For just such reasons, the most recent nursing home quality initiative from the CMS introduced a distinction between quality indicators for postacute and long-term care.[36]

The design of this study alleviates a number of potential threats to validity. The national sample provides a reasonable expectation of good external validity. The use of an admission sample with a wide range of covariates measured at baseline reduces the concern about "overadjustment" in the analyses and the confounding of resident and home effects. The range of quality indicators investigated included both general measures of cognitive and physical function and measures reflecting more specific conditions or care problems.

However, the study does have limitations. As always, to the degree that the models fail to include variables that significantly affect rates of decline and are highly correlated with locale, the estimated parameters for locale may be biased. A wide range of quality indicators, beyond the 9 included in this analysis, constitute important indicators of nursing home quality.[18,20] In addition, some might argue that higher death rates and higher rates of hospitalization do not unfailingly reflect poorer care. Investigations that analyze the risk of decline in other indicators over longer time periods may lead to different conclusions. In addition, the focus here has been solely on quality of care in nursing homes rather than the more global construct, the quality of life in nursing homes, of which quality of care is but 1 dimension.[37] ■

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Contributors

C. Hawes and C.D. Phillips developed the initial research questions and database. M. Sherman supervised the statistical analysis. S. Holan and M.L. Williams performed statistical analyses and contributed written sections for the initial draft. C.D. Phillips was primarily responsible for the initial interpretations of the results and drafting text. All authors participated in model development, reviewed results, reviewed article drafts, and provided comments and suggested revisions.

Human Participant Protection

This research was reviewed and approved by the institutional review board of Texas A&M University.

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